Air Force SBIR **Impact**

Increasing the Life Cycle of Gas Turbine Engine Airfoils

Company:
LSP Technologies, Inc.

Location:
Dublin, OH

Employees:
25

President:
Jeff L. Dulaney

AF Project Officer:
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Air Force Requirements:

The life cycle of gas turbine engine airfoils is of major importance to the Air Force, commercial engine manufacturers, and commercial airlines. Foreign object damage (FOD) in the leading edges of the airfoils and high cycle fatigue are serious concerns, because they can result in the destruction of the engine, loss of expensive aircraft, and loss of life. Beginning in 1991, the F101 engine used on the B-1 began experiencing failures of titanium turbine blades due to FOD caused by ice and hard objects ingested into the engine. Pieces of failed blades in some cases damaged or destroyed the rest of the engine. At that time, it was estimated that one to two engines would be lost per year. To avoid grounding the B-1 fleet, a time-consuming manual inspection was required of all the fan blades before each flight. In 1994, it was estimated that over one million man-hours were required to complete engine inspections and keep the B-1 flying.

SBIR Technology:

During that time, efforts were underway at General Electric Aircraft Engines (GEAE) under contract with the Air Force Research Laboratory to apply a technology called Laser Shock Peening (LSP) to the F-101 engine. LSP uses high power laser pulses to create high compressive residual stresses in the surfaces of metal parts. Tests demonstrated that the high cycle fatigue strength and FOD resistance of LSP-treated blades were remarkable. LSP virtually eliminated sensitivity to FOD defects up to 1/4

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of an inch long in F101 fan blades. By 1997, the beneficial effects of LSP were proven, and GEAE began production use of LSP using Laser Peen™ processing equipment designed and built by LSP Technologies, Inc. LSP Technologies was awarded a number of Small Business Innovation Research (SBIR) contracts to further develop its proprietary LaserPeen™ process.

Additional funding for further work on this technology was subsequently provided under a core Air Force Manufacturing Technology (ManTech) program to productionize laser peening of integrally bladed rotors (IBRs) for advanced aircraft engines.

Company Impact:

LSP Technologies (LSPT) has made considerable strides in making laser peening more affordable, and has demonstrated the benefits of LSP for many commercial applications. LSPT believes that laser peening will find many new uses in military and commercial aircraft engines and airframes as well as other industrial parts prone to fatigue failures.

Company Quote:

"The SBIR program provided the foundation to establish a production-ready manufacturing facility for laser peening. As a result of this program, LSP Technologies is able to offer laser peening services and equipment to government and industrial customers. We are grateful to the Air Force SBIR Program for their support."

Jeff L. Dulaney
President
LSP Technologies, Inc.

SBIR

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